Course Outcomes:

After the completion of the laboratory course the students will be able

1. To generate different types of signals, and use different operations on the signals for conditioning them.
2. To transform the continuous and discrete signals from time domain into frequency domain
3. To sample different types of signals in conformity with sampling theorem.
4. To apply base band modulation methods and line coding schemes to suit particular communication scheme.
5. To understand the process of serial and socket communication

List of Experiments:

Experiment 1:

1. Consider generating sinusoidal wave
   $X(n)=A\sin(2\pi(f/f_s)n+\Theta)$; $\Theta=\pi/2$; $N=64$; $A=1$; $f=1$ KHz ; $f_s=8$ KHz.
2. Generate exponential function signal from $t=0$ to 4 msec in steps of 0.01 msec.
   (a) $x(t)=e^{-0.8t}$
   (b) $x(t)=5e^{-0.2t}$
3. Consider generating discrete 64 samples of the sinusoidal wave
   $X[n]=A\sin(2\pi(f/f_s)n+\pi/4)$; $\Theta=0$; $N=64$; $A=1$; $f=1$ KHz ; $f_s=8$ KHz.
4. Generate signal for interval [-100,100]
   a. Unit impulse, $\delta(n)=1$ $(n=0)$;
   $\delta(n)=0$ (elsewhere)
   b. Step signal, $\delta(n)=1$ $(n\geq 0)$;
   $\delta(n)=0$ (elsewhere)

Experiment 2:

1. Multiply and add the following signal and plot original as well as transformed:
   (a) $X_1(t) = 5.3\cos(2\pi(f_o/f_s)n + \pi/4)$
   $X_2(t) = 4\cos(2\pi(f_o/f_s)n)$ take values of f_o, f_s, n conviniently.
   (b) $X_1(t) = e^{-0.1t}\sin(0.6t)$
   $X_2(t) = 1\ (t \geq 0);\ X_2(n) = 0 (t<0)$ $\{-100 \leq t \leq 100\}$
2. Perform the operation $\text{Ø}(t) = f(2t-6)$ i.e. delayed by 6 and compress by 2.
   (a) Continuous: $X(t) = e^{-2t}\cos(2\pi f_o t + \pi/3)$
   (b) Discrete : $X[n] = \cos(2\pi n/s)$
3. Perform the scaling operation $\text{Ø}(t) = f(at)$. Take value of a=2, 1/2, 1/4
   (a) $X_1(t) = 2\ e^{\wedge}\ \beta n$
   (b) $X_2(t) = 2\cos(2\pi n)$.Plot original as well as scaled signal.

Experiment 3:

1. Perform sampling on the signal $x(t) = A\sin(2\pi ft)$, taking the following sampling frequencies:
   (a) $f_s = 1.2f$
   (b) $f_s = 2f$
   (c) $f_s = 4f$. Take the values conveniently and show the implications of undersampling, oversampling.

Experiment 4:

1. Integrate and plot the signal (in frequency domain)
   (a) $e^{-2\pi ft}$
   (b) $e^{-i2\pi ft}$
2. Find the real and imaginary part of the signals
   (a) $\sin(2\pi ft)$
   (b) $\cos(2\pi ft).\ e^{-2it}$

Experiment 5:

1. Compute the fourier transform of the signal . use $-800 \leq f \leq 800$
   (a) $X(t) = \cos(2\pi 100t) + \cos(2\pi 500t)$
   (b) $X(t) = \sin(2\pi 200t)$
2. Generate a sinusoidal signal and plot its spectrogram using "spectrogram" in matlab.

Experiment 6:

1. Implement Laplace transform of the function $f(t) = -1.25 + 3.5te^{-2t} + 1.25e^{-2t}$.
2. Find the Inverse Laplace transform of the function

$$F(s) = \frac{s-5}{s(s-2)^2}$$

3. Find the z-transform of the function $x(n) = \frac{1}{4^n}u(n)$
4. Find the Inverse Z-transform of the function

$$X(z) = \frac{2z}{2z-1}$$

5. Express the following Z-transform in factored form, plot its poles & zeros.

$$H(Z) = \frac{z+1}{(z-\frac{1}{2})(z+\frac{1}{4})}$$

Experiment 7:

1. Generate signals according to convenience and perform the following operations:
   (a). Frequency Modulation.
   (b). Amplitude Modulation.
   (c). Phase Modulation with the following signals:

$$\left.\begin{aligned} e_m(t) &= E_m \operatorname{Sin}(\omega_m t) \\ e_c(t) &= E_c \operatorname{Sin}(\omega_c t) \\ e(t) &= E_c \operatorname{Sin}(\omega_c t + m \operatorname{Sin}(\omega_m t)) \end{aligned}\right\} \quad \text{Reference Equations}$$

Experiment 8:

1. Generate a square wave of frequency f_1 and perform Amplitude Shift Keying with the carrier wave $X=A \operatorname{Sin}(2\pi f_2 t)$, take the values conveniently.
2. Generate a square wave of frequency f_1 and perform Phase Shift Keying with the carrier wave
   $X=A \operatorname{Sin}(2\pi f_2 t)$, take the values conveniently.

Experiment 9:

1. Perform the following encoding schemes for the digital data: 011000111000011l011
   (a) Unipolar, Bipolar
   (b) NRZ-L,NRZ-I
   (c) Manchester Scheme, Differential Manchester Scheme
   (e) Pseudo ternary Scheme

Experiment 10:

1. Implement Serial communication with matlab.
2. Implement Socket communication with matlab.

Mapping of COs and POs:

COs	a	b	c
1	√	√	
2	√	√	
3	√	√	√
4	√	√	√
5		√	√

Evaluation Scheme: